

AGENCY REVIEW
RESPONSEAPPROVAL DRAFT

**Quality Assurance Project
Plan**
**Portland Harbor Pre-Remedial Design
Investigation and Baseline Sampling**
Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

March 22, 2018March 21, 2018March 20, 2018March 19, 2018March 8, 2018March 23, 2018

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~~January 18~~ March 23, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

QUALITY ASSURANCE PROJECT PLAN (QAPP)
PRE-REMEDIAL DESIGN INVESTIGATION AND BASELINE SAMPLING
PORTLAND HARBOR SUPERFUND SITE
PORTLAND, OREGON

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**CROSSWALK TABLE: ELEMENTS OF THE UFP-QAPP AND EPA QA/R-5
IN RELATION TO THIS QAPP**

Unified Federal Program (UFP)-QAPP Worksheet	EPA QA/R-5	AECOM/Geosyntec QAPP	Crosswalk to Other Project Documents
#1 Title and Approval Page	A1 Title and Approval Sheet	Title Page	--
#2 QAPP Identifying Information	--	Table of Contents and Section 1	--
#3 Distribution List	A3 Distribution List	Distribution List	--
#4 Project Personnel Sign-Off Sheet		Title Page	--
#5 Project Organization Chart	A4 Project/Task Organization	Section 2 and Figure 2	--
#6 Communication Pathways	--	Figure 3	AECOM/Geosyntec Project Management Plan (internal use document)
#7 Personnel Responsibilities and Qualifications	A4 Project/Task Organization	Section 2 and Figure 2	--
#8 Special Personnel Training Requirements	A8 Special Training/Certification	Section 3.4	--
#9 Project Scoping Sessions Participants Sheet	--	NA	--
#10 Problem Definition	A5 Problem Definition/Background	Section 3	--
#11 Project Quality Objectives/Systematic Planning Process Statements	A7 Quality Objectives and Criteria	Section 3.2	--
#12 Measurement Performance Criteria	A7 Quality Objectives and Criteria	Section 3.3, Tables 2a through 2e	--
#13 Secondary Data Criteria and Limitations	B9 Non-Direct Measurements	4.9	--
#14 Summary of Project Tasks	A6 Project/Task Description	Section 4.1	--
#15 Reference Limits and Evaluation	--	Tables 2a through 2e	--
#16 Project Schedule/Timeline	--		PDI Work Plan Section 5

Unified Federal Program (UFP)-QAPP Worksheet	EPA QA/R-5	AECOM/Geosyntec QAPP	Crosswalk to Other Project Documents
#17 Sampling Design and Rationale	B1 Sampling Process Design (Experimental Design)	Sections 3.2 and 4.1	--
#18 Sampling Locations and Methods/SOP Requirement	B2 Sampling Methods	Section 4.2, FSPs	--
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#20 Field Quality Control Sample Summary	B5 Quality Control	Section 4.6, Table 6	--
#21 Project Sampling SOP References	B2 Sampling Methods	Section 4.2	--
#22 Field Equipment Calibration, Maintenance, Testing, and Inspection	B6 Instrument/Equipment Testing, Inspection, and Maintenance	NA Section 4.7.2 Section 4.8	--
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#28 QC Samples Table	B5 Quality Control	Section 4.6, Tables 6 and 7	--
#29 Project Documents and Records	A9 Documents and Records	Section 3.5	AECOM/Geosyntec Data Quality Management Plan
	B10 Documentation/Data Management	Section 4.10	
#30 Analytical Services	B4 Analytical Methods	Section 4.1 Tables 2a through 2e	--

Unified Federal Program (UFP)-QAPP Worksheet	EPA QA/R-5	AECOM/Geosyntec QAPP	Crosswalk to Other Project Documents
#31 Planned Project Assessments	C1 Assessments and Response Actions	Section 5.1	--
#32 Assessment Findings and Corrective Action Responses	C1 Assessments and Response Actions	Section 5.1	--
#33 QA Management Reports	C2 Reports to Management	Section 5.2	--
#34 Data Review Verification (Step 1) Process	D1 Data Review, Verification, and Validation D2 Data Verification and Validation Methods	Section 6	--
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Acronyms:

AECOM = AECOM Technical Services

EPA = United States Environmental Protection Agency

FSP = Field Sampling Plan

Geosyntec = Geosyntec Consultants, Inc

NA = not applicable

PDI = pre-remedial design investigation

QA = quality assurance

QAPP = Quality Assurance Project Plan

QC = quality control

SOP = standard operating procedure

UFP = Unified Federal Program

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Acronyms:

EPA = United States Environmental Protection Agency
ODEQ = Oregon Department of Environmental Quality
QA/QC = quality assurance/quality control
QAPP = Quality Assurance Project Plan
TBD = to be determined

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Commented [dmk1]: See Table RLSO document, which details revisions to each table.

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Commented [dmk2]: Revised to add lab and boat launch locations.

Commented [dmk3]: Revised to add figure number and list Pre-RD AOC Group members.

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Commented [dmk4]: Revised to add method reference SM 2340B for hardness and add citations for tributyltin methods.

ACRONYMS AND ABBREVIATIONS

%R	percent recovery
°C	degrees Celsius
µg/L	micrograms per liter
AECOM	AECOM Technical Services
Alt F Mod	Alternative F Modified (EPA–selected remedy in the ROD)
AOC	Agreement Order on Consent
ASAO	Administrative Settlement Agreement and Order on Consent
BEHP	bis-(2-ethylhexyl) phthalate
bml	below mudline
CFR	Code of Federal Regulations
COCs	contaminants of concern
CPR	cardiopulmonary resuscitation
CRM	certified reference materials
CSM	Conceptual Site Model
D/F	dioxins/furans
D/U Reach	the Downtown Reach and the Upriver Reach
DDx	dichlorodiphenyltrichloroethane (DDT) and its derivatives
DI	deionized
DQIs	data quality indicators
DQMP	Data Quality Management Plan
DQOs	data quality objectives
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
<u>IDW</u>	<u>investigation-derived waste</u>
LCS/LCSD	laboratory control sample/laboratory control sample duplicates
LPM	laboratory project manager
LWG	Lower Willamette Group
MCP	methylchlorophenoxypropionic acid
MDL	method detection limit

mg/L	milligrams per liter
MQOs	measurement quality objectives
MS/MSD	matrix spike/matrix spike duplicate
ODEQ	Oregon Department of Environmental Quality
OSHA	United States Occupational Safety and Health Administration
PAHs	polycyclic aromatic hydrocarbons
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
PDA	personal data assistant
PDI	pre-remedial design investigation
PHSS	Portland Harbor Superfund Site
PP	peristaltic pump
PQL	project quantitation limit
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Group
<u>PRP</u>	<u>potentially responsible party</u>
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RM	river mile
ROD	Record of Decision
RPD	relative percent difference
RPM	remedial project manager
RSD	relative standard deviation
Site	Portland Harbor Superfund Site
SMA	sediment management area
SMB	smallmouth bass
SOP	standard operating procedures
SOW	Statement of Work
Striplin	Striplin Environmental Associates

SWACs	surface weighted average concentrations
TestAmerica	TestAmerica Laboratories, Inc.
TOC	total organic carbon
VOCs	volatile organic compounds

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS, Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), update current Site conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), with assistance from AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes the Statement of Work (SOW) and the PDI Work Plan (an attachment to the SOW), which generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

The PDI Work Plan (Geosyntec 2017) provides an overview of studies that will be prepared for the PDI at the PHSS. Environmental samples will be collected during the PDI at the PHSS and upstream. This Quality Assurance Project Plan (QAPP) establishes protocols that are necessary to ensure that the data generated are of a quality sufficient to support the data quality objectives (DQOs) and to ensure that valid conclusions are drawn from the PDI. To the extent practicable, protocols and information from previously approved QAPPs from the remedial investigation (RI) are referenced.

1.1 Objectives

This QAPP is one of several PDI planning documents submitted concurrently in fulfillment of Section 5.7 of the SOW. [The QAPP supports the Pre-Remedial Design Investigation Studies and Work Plans and the pre-remedial design sampling Baseline Sampling programs, and provides quality control \(QC\) elements to satisfy the DQOs for each task as specified in the ASAOC PDI Work Plan \(PDI-WP\).](#) Other concurrently submitted documents include the following:

- Field Sampling Plans (FSPs). Provide details for field sampling locations and procedures for seven project tasks and will be most frequently used by field staff on-site.
- PDI Data Quality Management Plan (DQMP; AECOM and Geosyntec 2018a). Provides details regarding data handling, reporting, database management, and final data upload.
- Health and Safety Plan (HASP; AECOM and Geosyntec 2018b). Identifies all physical, chemical, and biological hazards relevant to each field task and provides hazard mitigators to address these hazards.

1.2 Document Overview

This QAPP has been prepared according to the following EPA guidance documents:

- EPA Requirements of Quality Assurance Project Plans (EPA QA/R-5) (EPA/240/B-01/003, March 2001) (EPA 2001)
- Guidance for Quality Assurance Project Plans (EPA QA/G-5) (EPA/240/R-02/009, December 2002) (EPA 2002a)
- Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4) (EPA/240/B-06/001, February 2006) (EPA 2006)
- Uniform Federal Policy for Quality Assurance Project Plans Part 1 UFP-QAPP Manual, Intergovernmental Data Quality Task Force, March 2005, Version 1 (EPA-505-B-04-900A) (EPA 2005)

The first two documents cited above present a standardized QAPP format; this QAPP has been structured to reflect this format as closely as possible. The following major sections of this QAPP correspond to the sections prescribed in the QAPP guidance documents:

- Group A, Project Management, is addressed in the preceding signature page, table of contents, and Sections 1, 2, and 3 of this QAPP.
- Section 4 addresses Group B, Data Generation and Acquisition.
- Section 5 addresses Group C, Assessment and Oversight.
- Section 6 addresses Group D, Data Validation and Usability.
- Section 7 provides the references cited.

Certain recommended topics from EPA guidance concern field sampling protocols. These protocols are addressed in the task-specific FSPs included as part of the Pre-RD planning documents (and considered attachments to the QAPP); hence, they are briefly described in this QAPP.

2. PROJECT MANAGEMENT

This section presents the organizational structure for the sampling and analysis activities associated with the PDI. The Pre-RD AOC Group, under the oversight of EPA Region 10, is conducting the PDI. The PDI includes planning, fieldwork, laboratory analysis, data management, and data evaluation. The PDI project organization, major task responsibilities, and lines of authority are illustrated in Figure 2. Communication with EPA will be through these individuals. Names and contact information for the individuals listed below as well as other project team members are contained in Table 1.

2.1 EPA Organization and Responsibilities

The EPA is the lead agency for all Portland Harbor in-water PDI activities. EPA will oversee Pre-RD AOC Group activities associated with the PDI as described in the PDI Work Plan (Geosyntec 2017). EPA will coordinate all state, tribal, and agency partner participation per Section 7 of the SOW. The remedial project manager for EPA is Davis Zhen.

2.2 Pre-RD AOC Group Organization and Responsibilities

The Pre-RD AOC Group consists of Arkema Inc., Evraz Inc. NA, The Marine Group, and Schnitzer Steel Industries, Inc. These entities are signatories to the ASAOC. The Pre-RD AOC Group is responsible for conducting the PDI and reporting the results to EPA in documents in accordance with the PDI Work Plan (Geosyntec 2017) and ASAOC and referenced EPA guidance. All official communication with the Pre-RD AOC Group should be through the PDI Project Coordinator (Figure 3).

2.3 Pre-RD AOC Group Team Organization and Responsibilities

Consultants and contractors retained by the Pre-RD AOC Group will perform PDI sampling and analysis activities. The consultant team is responsible for implementation of these tasks at the direction and oversight of the Pre-RD AOC Group. Figure 3 presents the Communication Pathway for the project.

2.3.1 PDI Project Coordinator

Ken Tyrrell of AECOM will be the PDI Project Coordinator and will coordinate the overall PDI efforts. In this role, he will be the primary point of contact for information to and from EPA, on behalf of the Pre-RD AOC Group. In addition, he will oversee and coordinate PDI activities with the Pre-RD AOC Group consultant team and other technical consultants. The PDI Project Manager will report directly to Mr. Tyrrell along with other key team members to ensure that the objectives of the PDI field investigation are communicated to EPA and achieved.

If changes to the PDI FSPs or QAPP are needed, Mr. Tyrrell will discuss proposed changes with the Pre-RD AOC Group and EPA remedial project manager (RPM) or other designated EPA staff.

If immediate changes are needed based on conditions in the field or laboratory, the PDI Project Coordinator will notify the EPA RPM as soon as possible.

2.3.2 PDI Project Manager

Jenny Pretare, Ph.D., of AECOM will be the PDI Project Manager and will be responsible for all facets of the PDI program. Specific responsibilities include the following:

- Provide technical direction and oversight of all contractors.
- Ensure that laboratory capacity is sufficient to undertake the required analysis in a timely manner.
- Ensure adherence to the schedule by tracking sampling, laboratory analysis, validation, and data management tasks.
- Provide solutions to problems if they occur.

Dr. Pretare will conduct final data quality and reporting in compliance with the DQMP (AECOM and Geosyntec 2018a). She will report directly to Mr. Tyrrell, the PDI Project Coordinator.

2.3.3 Project QA/QC Manager

Amy Dahl, PhD of AECOM will be the project quality assurance/quality control (QA/QC) manager and will oversee all aspects of project QA and QC, which may include field and laboratory audits, review of field and laboratory reports, assessment of final data usability, limitations and completeness, review of field and laboratory non-conformance and corrective actions, and data validation oversight. Dr. Dahl will report directly to the PDI Project Manager.

2.3.4 Project Technical Leads

Anne Fitzpatrick of Geosyntec and Betsy Ruffle of AECOM will be the project technical leads. They will oversee all technical aspects of project planning, sample collection, reporting, and data evaluation activities to confirm compliance with the objectives stated in the PDI Work Plan (Geosyntec 2017). Ms. Fitzpatrick and Ms. Ruffle were the primary authors of the SOW and objectives described in the PDI Work Plan (Geosyntec 2017).

2.3.5 Project Field Coordinator

Nicky Moody of AECOM will be the project field coordinator and will be responsible for overall coordination of sampling and analysis tasks in the field. Her key responsibilities will include the following:

- Coordinate the field and laboratory analysis activities.
- Coordinate field support between multiple sampling events.

- Direct all aspects of the sampling events to ensure that the appropriate procedures and methods are used.
- Coordinate with laboratories to ensure the required analyses are conducted in a timely manner.

Ms. Moody will work closely with the PDI Project Manager. If problems occur in the field or if changes to the FSPs or the QAPP are warranted, she will immediately notify the PDI Project Manager. She will be supported by Keith Kroeger of Geosyntec.

2.4 Analytical Laboratory Services

Five analytical laboratories were selected by the Pre-RD AOC Group to perform the analyses identified by the PDI analytical program. The laboratory selection balances specific analytical capabilities at each location with analytical capacity sufficient to maintain the schedule set forth in the PDI Work Plan (Geosyntec 2017). Each laboratory maintains an internal QA program and is National Environmental Laboratory Accreditation Program-accredited for the analytical testing assigned to them. Tables 2a through 2e show the laboratories performing the specific analyses as well as each of the analytical tests per matrix.

2.4.1 ALS Environmental

ALS Environmental of Kelso, Washington, will perform sediment and suspended sediment (from traps) analysis for chlorinated pesticides, polycyclic aromatic hydrocarbons (PAHs), bis-(2-ethylhexyl) phthalate (BEHP), tributyltin, and total solids; fish tissue analysis for BEHP, arsenic and mercury; and surface water analysis (whole water for total fraction) for BEHP, pentachlorophenol, and tributyltin. The QA manual and a reference list of laboratory standard operating procedures (SOPs) for these analyses are included in Appendix A.

2.4.2 SGS Axys Analytical Services

SGS Axys Analytical Services of Sidney, British Columbia, Canada, will perform fish tissue analysis for chlorinated pesticides, hexachlorobenzene, polychlorinated biphenyl (PCB) congeners, dioxins and furans (D/F), polybrominated diphenyl ethers (PBDEs), and lipids; and will also perform surface water (XAD columns, dissolved fraction, and particulate [total fraction]) analysis for chlorinated pesticides, hexachlorobenzene, PCB congeners, PAHs, and D/F. The QA manual and reference list of laboratory SOPs for these analyses are included in Appendix A.

2.4.3 TestAmerica Laboratories, Inc.

TestAmerica Laboratories, Inc. (TestAmerica) Seattle of Fife, Washington, will perform sediment analysis and suspended sediment analysis (from traps) for PCBs (as Aroclors), ethylbenzene, total petroleum hydrocarbons–diesel range, metals (arsenic, cadmium, copper, lead, mercury, and

zinc), total solids, and grain size; surface water (whole water) analysis for ethylbenzene, methylchlorophenoxypropionic acid (MCP), metals (arsenic, calcium, chromium, copper, magnesium, and zinc), dissolved organic carbon, total dissolved solids, and total suspended solids; ~~and~~ porewater/bulk sediment analysis for metals (arsenic and manganese); ~~and porewater analysis for anions (bromide)~~. The QA manual and a reference list of laboratory SOPs for these analyses are included in Appendix A.

TestAmerica of Sacramento, California, will perform sediment and suspended sediment analysis (from traps) for D/F. The QA manual and a reference list of laboratory SOPs for this analysis are included in Appendix A.

TestAmerica of Knoxville, Tennessee, will perform sediment and suspended sediment (from traps) analysis for PCB congeners. The QA manual and a reference list of laboratory SOPs for this analysis are included in Appendix A.

TestAmerica of Burlington, Vermont, will perform Atterberg Limits analysis on surface and subsurface sediments. The QA manual and a reference list of laboratory SOPs for this analysis are included in Appendix A.

3. BACKGROUND AND OBJECTIVES

3.1 Site Location and Description

The Portland Harbor Superfund Site is approximately 2,190 acres and extends from river mile (RM) 1.9 to RM 11.8 of the Lower Willamette River. The PDI Study Area extends upstream to RM 28.4 and includes the Downtown Reach and the Upriver Reach (D/U Reach). The shoreline along most of the Portland Harbor area was developed for industrial, marine, commercial, defense, and municipal operations; contaminants from many facilities and combined sewer overflow entered the river system over 100 years of industrialization, resulting in contamination observed in sediment, surface water, and biota tissue. Site background and other Site characteristics are described in detail in the Final Remedial Investigation Report (EPA 2016a).

On December 1, 2000, the Site was listed on the National Priorities List by EPA mainly due to concerns about potential risks to human health and the environment from consuming fish. The most widespread contaminants found at the Site include, but are not limited to, the focused contaminants of concern (COCs), which include PCBs, PAHs, dichlorodiphenyltrichloroethane (DDT) and its derivatives (DDx), and D/F. A remedial investigation and feasibility study (RI/FS) was initiated in 2001 by a small subset of potentially responsible parties (PRPs) known as the Lower Willamette Group (LWG), and completed by EPA in 2016 (EPA 2016a, 2016b). The EPA issued a ROD on January 3, 2017, which detailed the selected final remedy for the in-river portion of the Site. The ROD described a post-ROD sampling effort for the Site to delineate and better refine the SMA footprints, refine the CSM, update current conditions, and support remedial design (EPA 2017a). The PDI is intended to assist in meeting the objectives of the post-ROD sampling effort.

3.2 Data Quality Objectives

To generate data that will meet the PDI objectives, it is necessary to define the types of decisions that will be made, identify the intended uses of the data, and design a data collection program. These are steps in the DQO process. DQOs entail the desired type, range of applicability, and quality of data based on desired decisions and acceptable decision errors. Articulating DQOs is necessary to ultimately obtain sufficient data of known defensible quality for the intended use. The DQO process will assist in determining the necessary quantities, quality, sensitivity, sample handling procedures, and data assessment requirements for the data collected.

The DQO development presented herein adheres to the framework presented in the EPA document “Guidance on Systematic Planning Using the Data Quality Objectives Process” (EPA 2006). The following subsections provide an overview of the seven-step process and DQOs for the PDI. Additional detail for the DQOs for the PDI, showing the seven-step process for each project task, is provided in Table 3.

The goals and input sections below describe the basic elements that are not anticipated to change over the course of the PDI. However, additional details may be added to each as the final FSPs are developed. The final version of this QAPP will be updated to fully describe the inputs and goals for each task described below as well, as detailed in Table 3.

3.2.1 Step 1: State the Problem

The ROD states that a post-ROD sampling effort is conducted to support the remedial design, refine the CSM, and establish a baseline dataset for comparison to post-remedy conditions. This PDI study covers many elements outlined by EPA for post-ROD sampling and data collection, including: surface and subsurface sediment, surface water, sediment porewater, bathymetry, and fish tissue (smallmouth bass [SMB]). The PDI is intended to assist in meeting ROD objectives and to provide the post-ROD sampling data to support the remedial design.

3.2.2 Step 2: Identify the Goals of the PDI

~~Based on the review of the selected Remedial Alternative F Modified SMA footprint (Alt F Mod) and existing data, the following information should be collected for each goal listed below during the PDI to assist in the pre-remedial design process. As stated in the PDI Work Plan (Geosyntec 2017), the PDI activities are focused on achieving the following goals:~~

- ~~1) Implement investigation baseline sampling to update existing site-wide data.~~
- ~~2) Gather data to be used as part of baseline dataset for future long-term monitoring.~~
- ~~3) Assist in refining the scope and extent of the remedial actions that will be performed at the Site, including refining SMAs, informing technology assignments consistent with the decision tree in the ROD (Figure 28) throughout the Site, and refining the horizontal and vertical extent of the dredging and capping areas.~~
- ~~4) Collect data to facilitate completion of the third-party allocation by PRPs; this allocation process is independent of EPA oversight.~~
- ~~5) Collect additional data regarding upstream conditions and contaminant loading into the Site; and.~~
- ~~6) Update and evaluate Site conditions to refine the CSM for all pathways consistent with the ROD, page 106 (Post-ROD Data Gathering).~~

~~**Goal 1** — Create a detailed, accurate, up-to-date bathymetric data set of the Site.~~

~~**Goal 2** — Establish current sediment baseline conditions (surface weighted average concentrations (SWACs) and CSM) to evaluate future remedy performance and progress towards~~

~~remedial action objectives. Establish current sediment surface weighted average concentrations (SWACs) throughout the Site.~~

~~Goal 3—Refine the active remedial SMA footprints to support allocation efforts. This includes refining the horizontal and vertical extent of sediment contamination at concentrations greater than the Remediation Action Levels.~~

~~Goal 4—Evaluate statistically significant changes of PCBs, PAHs, D/F, and DDX (focused COCs) in sediment sample concentration differences and changes over time.~~

~~Goal 5—Characterize upriver concentrations of COCs in sediment and sediment traps and provide a line of evidence on incoming sediment load to the Site.~~

~~Goal 6—Determine current baseline conditions in surface water at the Site for COCs, provide a line of evidence on incoming surface water quality to the Site, and refine the CSM.~~

~~Goal 7—Determine background porewater concentrations of naturally occurring arsenic and manganese.~~

~~Goal 8—Characterize current levels of fish tissue COCs in resident SMB at the Site.~~

~~Goal 9—Characterize upriver concentrations of COCs in resident SMB.~~

~~Goal 10—Update statistically based evaluations of PCB concentrations and changes in fish tissue.~~

~~Goal 11—Determine temporal and spatial movements of SMB at the Site.~~

3.2.3 Step 3: Identify Information Inputs

To achieve the goals of the PDI, the following media-specific information inputs will be collected:

Inputs for Goal ~~4-3~~ – Bathymetry - To develop a detailed bathymetric data set of the Site, a site-wide multi-beam high-resolution sonar survey will be conducted throughout the Site, and the survey will be supplemented with single-beam measurements in nearshore areas to provide adequate spatial coverage. Details of the bathymetry survey are provided in the Bathymetry Survey FSP.

Inputs for Goal 1 – Sediment - To determine the current baseline river bed conditions throughout the Site, a total of 666 surface sediment samples (428 stratified random samples, 178 targeted samples located in SMA areas, and 60 targeted surface sediment samples co-located with in-water core samples) will be collected and analyzed for the sediment COCs listed in Table 2a and 2b of this QAPP.

Inputs for Goal 2 – Sediment - To help develop the baseline dataset for long-term monitoring, collect 428 stratified random surface sediment samples will be collected, and SWACs will be developed SWACs throughout the Site; (at the spatial scales described in the PDI Work Plan). -a total of 666 surface sediment samples (428 stratified random samples, 178 targeted samples located in SMA areas, and 60 targeted surface sediment samples co-located with in-water core samples) Samples will be collected and analyzed for the sediment COCs listed in Table 2a and 2b of this QAPP. The basis and rationale for placement of the stratified random samples is described in the PDI Work Plan.

Inputs for Goals 3 and 4 – Sediment - To refine the SMA footprints, 238 targeted (non-random) surface sediment samples (178 targeted samples and 60 targeted samples co-located with sediment in-water core samples) will be collected from SMA areas. To refine the horizontal and vertical extent of sediment contamination, 90 sediment core locations within or along the boundaries of the SMA will be collected. Sediment samples will be analyzed for the sediment COCs listed in Table 2a of this QAPP. These data will be used collectively with the recent surface sediment samples and historical subsurface data to refine the SMA footprints. Some of the stratified random samples may also be used to refine the SMA footprints if their locations happen to fall near and/or within the Alt F Mod footprint. See the FSP's for sediment grab and core placement rationale.

Inputs for Goal 4-6 – Sediment - To the extent that PDI surface sediment samples fall near sediment sample locations evaluated in earlier studies, these samples will be used to evaluate changes in concentrations. Segment-wide, area-wide, and site-wide SWACs may also be evaluated for changes over time.

Inputs for Goal 5 – Upriver Sediment - To provide information on the sediment loads entering the Site, sediment traps will be deployed at RM 11.8 and RM 16.6 (Downtown Reach) over three flow conditions. A total of 60 surface sediment samples (30 samples from Downtown Reach and 30 samples from Upriver Reach) will be collected targeting representative % fines and total organic carbon (TOC) content to Site sediments. The sediment trap and upstream surface sediment samples will be analyzed for the sediment COCs listed and Table 2b of the QAPP (full ROD COC list for sediment) and select samples for geotechnical parameters (Atterberg Limits). Proposed sampling locations are presented in the Surface Water and Sediment Trap FSP and the Surface Sediment Sampling FSP. These data will be supplemented with upriver surface sediment and surface water data lines of evidence.

Inputs for Goals 6-1 and 2 – Surface Water - To determine the current baseline surface water conditions, seven composite water samples (vertically and horizontally composited) will be collected from five transects distributed across the Site, and two upriver transects, one in the Downtown Reach and one in the Upriver Reach over three flow conditions. A total of 21 samples will be collected from either the low-volume peristaltic pump (PP) or high-volume XAD sampling methods. The surface water samples will be collected at proposed locations on Figure 2

of the Surface Water and Sediment Trap FSP and analyzed for the surface water COCs listed in Table 2c of the QAPP. Table 2c illustrates which analytes will be collected by the PP method or the XAD method. The PP method can collect a whole water sample or a field filtered sample for dissolved metals. The XAD method collects a dissolved water sample and a dry solids sample, which allow the total concentrations to be calculated.

Inputs for Goal ~~7-5~~ – Background Porewater - To determine background porewater concentrations of naturally occurring arsenic and manganese, eight porewater samples will be collected during low-flow summer conditions. The porewater samples will be analyzed for arsenic and manganese as listed in Table 2d.

Inputs for Goals 1 and 2-8 – Fish Tissue - To determine current levels of fish tissue COCs in resident SMB at the Site, a total of 95 SMB samples will be collected from four segments across the Site. The SMB samples will be analyzed for the fish tissue COCs listed in Table 2e.

Inputs for Goal ~~9-5~~ – Upriver Fish Tissue - To characterize upriver concentrations of COCs in resident SMB, a total of 40 SMB samples will be collected throughout the D/U Reaches (20 in the Downtown Reach and 20 in the Upriver Reach). The SMB samples will be analyzed for the fish tissue COCs listed in Table 2e.

Inputs for Goal ~~40-6~~ – Fish Tissue - To update statistically based evaluations of PCB differences and changes in fish tissue, the PDI SMB data will be statistically compared to the SMB data collected in 2012 and other time periods as appropriate.

Inputs for Goal ~~44-6~~ – Fish Tracking - To determine temporal and spatial movements of SMB at the Site, an array of acoustic receivers will be placed throughout the Site from spring 2018 to spring 2019.

3.2.4 Step 4: Define the Boundaries of the Study

The Site extends from RM 1.9, near the mouth of the Willamette River, upstream to RM 11.8 (Figure 1). The temporal boundary for the study will be to complete field sampling activities by winter 2019. The upriver boundary of the sampling area extends from RM 11.8 up to RM 28.4. No samples will be collected downstream of the Site or the Multnomah Channel; however, a bathymetry survey will be performed up the mouth of the channel to the Sauvie Island Bridge to ensure adequate data resolution within the Site.

3.2.5 Step 5: Develop the Analytical Approach

The field investigation component of the PDI will collect site-specific data integral to achieving the goals of the study listed above. Data will be collected from the bathymetric survey, surface and subsurface sediment, sediment traps, surface water, porewater, SMB fish tissue, and fish tracking sampling events at the Site and D/U Reaches. Data will be evaluated using the analytic

approaches or “if/then” statements listed in Table 3 of this QAPP. They reflect the decision statements that are based on the data inputs for each task as listed above.

Samples of each of the matrices listed above will be collected from the locations presented in the figures contained in each task-specific FSP and analyzed for the parameters listed in the Table 2 series; results will be assessed against the ROD cleanup levels listed in Tables 2a through 2e of this QAPP.

3.2.6 Step 6: Specify Performance or Acceptance Criteria

The measurement performance criteria for data associated with the specific analyses include precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). To meet PARCCS requirements, QC criteria are provided in the standard field and laboratory methods. These criteria include the use of the following:

- Field duplicates, laboratory duplicates, laboratory control sample/laboratory control sample duplicates (LCS/LCSD), and matrix spike/matrix spike duplicate samples (MS/MSD) to assess precision
- Matrix spikes, LCS, surrogates, calibration results, and field and method blanks to assess accuracy and bias
- Field sampling design and sample collection SOPs to determine representativeness
- Standard methods and the consistent use of field and laboratory SOPs, method detection limit (MDL) studies, and calibration to achieve comparability
- Blanks, including field and laboratory QC blanks, to determine and assess sensitivity, cross-contamination, and bias

Specific objectives for each PARCCS criterion are established to develop sampling protocols, applicable documentation, sample handling procedures, and measurement system procedures that will be used during field activities associated with the PDI. These are described in more detail in Section 3.3, and the criteria are presented in Tables 2a through 2e.

3.2.7 Step 7: Develop the Plan for Obtaining Data

The PDI strategy is based upon the ROD, the scope of work contained in the PDI Work Plan, and technical information contained in the individual FSPs. The basis of the sampling design and rationale for the PDI tasks are presented in Section 3 of the PDI Work Plan (Geosyntec 2017), and the specific sediment, surface water, porewater, and fish tissue sampling locations to be sampled are identified in their task-specific FSPs. Some of these proposed locations, especially upriver surface sediment sampling locations, will be confirmed after field reconnaissance surveys have been completed.

3.3 Quality Objectives and Criteria of Measurement

3.3.1 PARCCS Overview

This QA program addresses both field and laboratory activities. Quality assurance objectives are formally measured through the computation of performance measures known as data quality indicators (DQIs), which are in turn compared to pre-defined Measurement Quality Objectives (MQOs) specific to the project objectives (EPA 2002). The DQIs for measurement data are expressed in terms of PARCCS. Evaluation of DQIs provides the mechanism for ongoing control and evaluation of data quality throughout the project, and ultimately will be used to define the data quality achieved for the various measurement parameters. The field QA/QC program will be accomplished through the collection of field duplicates, equipment (rinsate) blanks, field blanks, MS/MSD, and trip blanks, as applicable. The analytical QA/QC program will be assessed through the internal laboratory QC performed, including but not limited to method blanks, LCS recoveries, surrogate recoveries, and MS/MSD recoveries. The following sections describe the DQIs in greater detail, with a discussion of the associated MQOs.

3.3.2 Precision

Precision refers to the reproducibility or degree of agreement among duplicate measurements of a single analyte. The closer the numerical values of the measurements, the more precise the measurement. Poor precision stems from random errors (i.e., mechanisms that can cause both high and low measurement errors at random). Precision is usually stated in terms of standard deviation, but other estimates, such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum values), and relative range are common and may be used pending review of the data.

~~Precision will be determined through the collection of field duplicates and the analysis of MS/MSD and LCS/LCSD pairs for the work performed at the Site. The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision; there are more historical data related to individual method performance, and the "universe" is not limited to the samples received in the laboratory. In contrast, sampling precision is unique to the project. Sampling precision will be measured through the laboratory analysis of field duplicate samples. Laboratory precision will be measured through the analysis of MS/MSD pairs, LCS/LCSD pairs, and laboratory duplicate pairs.~~

During the collection of data using field methods and/or instrumentation, precision is checked by reporting several measurements taken at one location and comparing the results. ~~For field duplicates, homogenized samples from the sample collection device will be split into two samples for analysis to assess measurement sample homogenization and matrix heterogeneity variability (sediment).~~ Precision will be determined from replicate/duplicate samples and will be

expressed as the relative percent difference (RPD) between replicate/duplicate and parent sample results, computed as follows:

$$RPD = \frac{X_1 - X_2}{(X_1 + X_2)/2} \times 100$$

where X_1 and X_2 are reported concentrations for each replicate sample and subtracted differences represent absolute values. For field duplicates, the precision goals for this project are as follows: 1) RPD = 50% for solid samples; and 2) RPD = 30% for liquid samples. Field duplicates will not be possible for fish tissue because of sample volume requirements. For laboratory duplicates (chemistry), the RPD goals are defined by the laboratory acceptance criteria determined from control limits or defined by the specific method. With regard to grain size analysis, laboratory triplicates and relative standard deviation (RSD) goals are defined by the laboratory acceptance criteria as defined by the specific method.

Precision will be determined through the collection of field duplicates and the analysis of MS/MSD and LCS/LCSD pairs for the work performed at the Site. The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision; there are more historical data related to individual method performance, and the "universe" is not limited to the samples received in the laboratory. In contrast, sampling precision is unique to the project. Sampling precision will be measured through the laboratory analysis of field duplicate samples. For field duplicates, homogenized samples from the sample collection device will be split into two samples for analysis to assess sample homogenization and matrix heterogeneity variability (sediment). Laboratory precision will be measured through the analysis of MS/MSD pairs, LCS/LCSD pairs, and laboratory duplicate pairs. Laboratory duplicate pairs are used to assess the precision or variability of the laboratory process.

3.3.3 Accuracy and Bias

Accuracy refers to the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement. The converse of accuracy is bias, in which a systematic mechanism tends to consistently introduce errors in one direction or the other. Bias in environmental sampling can occur in one of three ways; these mechanisms and their associated diagnostic and management methods are as follows:

- High bias, which can stem from cross-contamination of sampling, packaging, or analytical equipment and materials. Cross-contamination is monitored through blank samples, such as equipment blanks, field blanks, trip blanks, filter blanks, and method blanks. These samples assess the potential for cross-contamination from, respectively,

sampling equipment, ambient conditions, packaging and shipping procedures, field filters, and laboratory equipment. Data validation protocols provide a structured formula for data qualification based on blank contamination.

- Low bias, which can stem from the dispersion and degradation of target analytes. An example is the volatilization of chlorinated solvents during field sampling. The effects of these mechanisms are difficult to quantify. Sampling accuracy can be maximized, however, by the adoption and adherence to a strict field QA program. Specifically, sampling procedures will be performed following the standard protocols described in the FSPs; for example, eliminating headspace in sampling vials for volatile organic compounds (VOCs) will reduce the potential for dispersion of VOCs during sampling. Through regular review of field procedures, deficiencies will be documented and corrected in a timely manner.
- High or low bias can occur due to poor recoveries, poor calibration, or other system control problems. The effects of these mechanisms on analytical accuracy may be expressed as the percent recovery of an analyte that has been added to the environmental sample at a known concentration before analysis. Analytical accuracy in the laboratory will be determined through the analysis of surrogates, LCSs, and MS/MSDs. As with blank samples, data validation protocols provide a structured formula for data qualification based on high or low analyte recoveries outside of the laboratory and/or method acceptance limits.
- Accuracy, when potentially affected by high or low recoveries as described in the third bullet above, is presented as percent recovery (%R), which is defined as:

$$\% R = \frac{\text{Spiked Sample Concentration} - \text{Sample Concentration}}{\text{Spike Concentration}} \times 100$$

- Accuracy goals for analytical results are presented as upper and lower control limits for LCS and MS/MSD percent recovery in Tables 2a through 2e. -Laboratory control limits will be used for the accuracy goals for surrogates. [The current values are presented for informational purposes only. Data review/validation will be based on the most current laboratory control limits in effect at the time of analysis.](#)

3.3.4 Representativeness

Representativeness is defined by the degree to which the data accurately and precisely describe a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. If the results are reproducible, the data obtained can be said to represent the environmental condition. Representativeness is ensured by collecting sufficient numbers of samples of an environmental medium, properly chosen with respect to place and time. The precision of a representative set of samples reflects the degree of variability of the sampled medium as well as the effectiveness of the sampling techniques and laboratory analysis.

The Pre-RD AOC Group in collaboration with EPA has developed a statistically robust and valid multi-media PDI sampling program that will achieve many of the ROD objectives. The statistical basis for development of the sediment and tissue sampling scope is described in Appendices B and C respectively of the approved PDI Work Plan (Geosyntec 2017). Based on these analyses, the PDI samples are expected to represent current conditions within the Site.

3.3.5 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. The completeness goal is essentially the same for data uses in that sufficient amounts of valid data are to be generated.

There are limited historical data on the completeness achieved by individual methods. However, based on historical datasets associated with the EPA's Contract Laboratory Program, data have been found to be 80% to 85% complete on a nationwide basis.

The percent completeness for each set of samples will be calculated as follows:

$$\% \text{ Completeness} = \frac{\text{Valid Data}}{\text{Total Data Planned}} \times 100$$

The QA objective for completeness for the parameters will be 90%.

3.3.6 Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured using established and approved analytical methods, consistency in the basis of analysis (wet weight, volume), consistency in reporting units (micrograms per liter [µg/L], milligrams per liter [mg/L]), and analysis of standard reference materials. Comparable data sets must contain the same variables of interest and must possess values that can be converted to a common unit of measurement. Comparability is normally a qualitative parameter that is dependent upon other data quality elements. For example, if the detection limits for a target analyte were significantly different for two different methods, the two methods would not be comparable. By using standard sampling and analytical procedures, and carefully assessing laboratory capabilities, datasets will be comparable.

3.3.7 Sensitivity

Sensitivity refers to the minimum magnitude at which analytical methods can resolve quantitative differences among sample concentrations. If the minimum magnitude for a particular analytical method is sufficiently below an action level or risk screening criterion, then the method sensitivity is deemed sufficient to fully evaluate the dataset with respect to the desired reference values. Frequently, risk-based screening levels fall below the sensitivity of even the most sensitive analytical methods. In such cases, it is necessary to review the qualifications of

several laboratories, both from the standpoint of sensitivity as well as other DQIs, to select the best laboratory for the project.

The MDL is a theoretical limit determined through an MDL study in which the concentration of a spiked solution is tested at least seven times and the concentration of method blanks is tested at least seven times. The standard deviation of the recovered concentrations is computed and multiplied by the t-distribution value to arrive at the MDL. The higher of the two MDLs is then used as the MDL for the analyte and test method. The project quantitation limit (PQL), sometimes referred to as the reporting limit (RL), is a quantifiable value and usually the lowest concentration standard used in the calibration curve. In practice, to allow for matrix interferences variability in instrument control, a RL of three to eight times the MDL is typically selected.

Analytical sensitivity is readily evaluated by comparing method RLs and/or MDLs to risk-based screening values, such as ROD Table 17 COC cleanup levels. The results of this analysis are presented in Tables 2a through 2e of this QAPP, which demonstrate the suitability of the selected methods to meet the project requirements within the limits of technical practicability. Both the PQLs and the MDLs will be recorded in the project database; however, analytical results will be reported to the MDLs consistent with previous RI studies to meet the majority of the project reporting requirements.

3.4 Special Training / Certifications

Health and safety training will include the following:

- Initial training of Site workers in 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER), per 29 Code of Federal Regulation (CFR) 1910.120, with supervisor training for the field manager and annual 8-hour refresher training thereafter for all field staff
- Project Field Coordinators will have United States Occupational Safety and Health Administration (OSHA) 10 (or 30) hour Hazard Awareness Training for Construction or Maritime Related Industries
- Annual training in cardiopulmonary resuscitation (CPR)
- Triennial first aid training
- Baseline and annual medical monitoring

All sampling personnel will have completed the 40-hour HAZWOPER training course and 8-hour refresher courses, as necessary. The 40-hour course meets the OSHA regulation 29 CFR 1910.120(e)(3). Documentation of course completion will be required, and copies will be maintained in personnel files. All subcontractors performing work during the PDI will be required to conduct all activities in accordance with applicable health and safety regulations and site-specific requirements. A copy of the project HASP will be provided to each subcontractor.

However, subcontractors will be responsible for the health and safety of their personnel while working at the Site. Each day before work commences, a tailgate health and safety meeting will be conducted by the field coordinators with participation by the full contractor field team.

All sampling activities conducted during the PDI will be performed by individuals with training and experience in the specific sampling and monitoring techniques. Individuals collecting samples will be trained, as necessary, on the specific requirements provided in the field SOPs.

3.5 Documentation and Records

Documentation involves generating, maintaining, and controlling field data, laboratory analytical data, field logs, reports, and any other data relevant to the project. Bound field logbooks, loose-leaf coring logs, or automated field data entry records generated with personal data assistants (PDAs) are examples of documents. This project will have dedicated field logbooks, forms, and databases that will not be used for other projects. Entries will be dated, and the time of entry will be recorded. Sample collection data as well as visual observations will be documented on forms or PDAs or, when forms are not available or applicable, in the field logbook. To the extent possible, field data will be recorded on field forms or PDAs and not repeated in the field notebook. Any sample collection equipment, field analytical equipment, and equipment used to make physical measurements will be identified in the field documentation. Calculations, results, equipment usage, maintenance, and repair and calibration data for field sampling, analytical, and physical measurement equipment will also be recorded in field documentation. Once completed, the field forms, field databases, and field logbook will become part of the project file.

Office data management will involve establishing and maintaining a project file. The project file will include the following:

- PDI planning documents, such as this QAPP
- FSPs and schedules
- SOPs (for both the field and laboratory)
- Field sampling logs
- Field screening data
- QA auditing and inspection reports
- Laboratory analytical data
- Calculations
- Drawings and figures
- Reports
- External and internal correspondence

- Notes/minutes of meetings and phone conversations
- Contract/purchase orders
- Change orders
- Bid evaluations

All project-related information will be routed to the PDI Project Manager who will be responsible for distributing the information to appropriate personnel. The official project files will be maintained in the Seattle, Washington, offices of AECOM and Geosyntec. Project documentation will be archived for a minimum of 10 years after completion of the remedial action, as required by the ASAOC.

4. DATA GENERATION AND ACQUISITION

4.1 Sample Design

Below are overviews of the sampling designs for the various components of the PDI. Complete sampling designs and rationales are described in the PDI Work Plan (Geosyntec 2017) and individual FSPs. A total of seven FSPs have been developed for the PDI study and will eventually be included as attachments to this QAPP. These include FSPs for bathymetry, surface sediment sampling, subsurface sediment coring, fish tissue sampling, surface water and sediment trap sampling, fish tracking, and porewater sampling.

4.1.1 Bathymetry Survey

The bathymetry survey is designed to produce an up-to-date bathymetric survey of the Site with a high level of detail and accuracy. Multi-beam sonar will be used to collect high-resolution data throughout the Site, supplemented with single-beam data in difficult access areas, with ~~up to a~~ survey goal of 80 to 100% coverage of the riverbed, as some areas will be difficult to cover (e.g., under docks, around ships, inside oil booms, etc.).

4.1.2 Surface Sediment Sampling

Three kinds of surface sediment data will be collected: stratified random samples within a grid system, targeted non-random samples located in the SMA areas, and co-located samples to correspond with sediment core samples also placed in SMA areas. The stratified random sample design is based on a geostatistical analysis approach to maintain or improve upon the level of variability in the SWACs generated using 2004 data and in most areas and assessment segments, and to enable the design to statistically detect differences ($\alpha = 0.05$) between 2004 SWACs and current SWAC estimates with an approximate 80% level of statistical power. Additional samples may be added to the current scope of work, with the purpose of re-occupying old 2004 surface sediment stations (or other period more than 10 years old). The targeted samples placed in SMA areas are designed to further refine the SMA footprints (along with the subsurface data) and inform the decision tree described in the ROD. ~~It is expected that any newly collected surface sediment sample, if collected within a reasonable distance of an older sample, would replace the older data for the purposes of SMA refinement; randomly placed samples may also be useful for SMA delineation if they happen to be located near or within an SMA.~~

4.1.3 Subsurface Sediment Coring

Subsurface sediment coring is designed to refine the vertical and horizontal extent of contamination. Ninety subsurface core locations are planned in targeted areas within or along the boundaries of SMAs that have limited spatial coverage both vertically and horizontally. A distance of 250 to 300 feet was used as a general guide for spacing to the next nearest coring location. Target core depths range from 6 feet below mudline (bml) for shallow, nearshore cores,

up to 20 feet bml for deep cores, with 3 to 8 samples collected per core assuming 2-foot sample intervals.

4.1.4 Sediment Trap Sampling

The sediment trap sampling is designed to provide information on the incoming sediment load to the Site. Four sediment traps, two at RM 11.8 and two at RM 16.2, will be deployed over three flow conditions (summer low-flow, winter high-flow, and storm flood-influenced conditions) to collect fine-grained, more mobile suspended sediment and higher TOC material that is more likely to move downstream and be deposited at the Site.

4.1.5 Surface Water Sampling

The objective of surface water sampling is to [develop](#) baseline river conditions with synoptic data (sediment, fish tissue, surface water), evaluate surface water current conditions and changes, and provide 2018 data to refine the CSM for remedial design purposes. Surface water will be collected from seven transect locations as cross-section composite samples over three flow conditions (summer low-flow, winter high-flow, and storm flood-induced conditions) that coincide with the sediment trap sampling events.

One composited sample will be collected per transect (similar to the RI/FS data use approach). The objective of the composite sample design is equal volume across the cross-sectional area of the segment. A total of 21 samples will be collected using PP (low-volume) and high-volume XAD samplers, consistent with the RI/FS.

4.1.6 Fish Tissue Sampling

The fish tissue sampling design will split the Site into four segments and will target collecting 20 to 30 SMB from each segment. Twenty SMB samples will also be targeted for collection from the Downtown Reach and 20 SMB will be targeted from the Upriver Reach. The objectives of the fish tissue sampling study include characterization of current levels of fish tissue COCs in resident fish tissue, characterization of upriver concentrations in resident fish tissue, an update of statistically based evaluations of PCB differences and changes in fish tissue, and an update and evaluation of Site conditions to refine the CSM for all pathways consistent with the ROD.

4.1.7 Fish Tracking Study

The fish tracking study will be conducted throughout the Site using an array of acoustic receivers. The receivers will be placed at 34 locations, and 40 SMB will be tagged and monitored for a period of 1 year. Equipment will be periodically checked for performance and data downloaded at 3-month, 6-month, and 12-month intervals. The design will capture fine-scale temporal and spatial movement of SMB that can be used to understand SMB movement in the study area.

4.1.8 Porewater Sampling

Porewater samplers (peepers) will be deployed, in triplicate, in the sediment bed in areas that are representative of background arsenic and manganese concentrations. Eight sampling locations will be placed in upstream areas or other relevant areas from within the Site that meet target conditions (outside of SMAs, high TOC, high percent fines, low redox, near wetlands, etc.). Peepers will be co-located with surface sediment sampling locations and sediment will be pre-screened for arsenic and manganese. Porewater data will be used to assist in the development of background metals, porewater concentrations of arsenic and manganese, and to further inform remedial action objectives.

4.2 Sample Methods

The task-specific FSPs for each media type contain complete descriptions of the sample collection and handling methods. The types and numbers of samples that will be collected, the rationale for collection, and the analyses that will be performed are discussed in the FSPs. The sections below provide a general description of the sampling methods.

4.2.1 Sample Nomenclature Scheme

Sample containers will be labeled with an identification number that uniquely identifies the sample. The sample nomenclature number will be logged in the field logbook or applicable sampling form as prescribed in the task-specific FSPs, along with the following information about the sampling event:

- Sampling personnel
- Date and time of collection
- Field sample location and depth (as appropriate)
- Type of sampling (composite or grab)
- Method of sampling
- Sampling matrix or source
- Intended analyses

The sample nomenclature design includes up to five components. Component 1 is the PDI study. Component 2 is the matrix type (sediment, water, tissue). Component 3 is the unique station code. Component 4, if needed, provides more detail about a sample such as core sample depth, monitoring round, or low-flow sample event. Component 5 is for the field duplicate designation. Table 4 further describes the sample nomenclature design for all media and the QA/QC samples.

4.2.1.1 Surface Sediment Sample Nomenclature

The sample nomenclature for surface sediment samples will consist of up to five components: a three-letter project identification code, followed by a sample matrix code, a sample station code, a monitoring round code (for baseline monitoring sites), and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-SG-B001-BL1 = Pre-design investigation, surface sediment grab, from baseline monitoring station #1, baseline monitoring round #1.
- PDI-SG-S110 = Pre-design investigation, surface sediment grab, sediment management area station #110.
- PDI-SG-B001-BL1-D = Pre-design investigation, surface sediment grab, baseline monitoring station #1, baseline monitoring round #1, field duplicate sample.
- Samples collected for MS or MSD purposes will have the same sample identification as the original sample and will be indicated on the same line on the ~~COC~~Chain-of-Custody Record as the original sample with a comma and then -MS, -MSD next to it. Alternatively -MS, -MSD may be entered in the comment section for line on the ~~COC~~Chain-of-Custody Record where the original sample ID is listed. Either way, the sample will be considered a single sample and will not be considered three discrete samples.
- ~~PDI-SG-S110-MSD = Pre-design investigation, surface sediment grab, sediment management area station #110, MSD sample~~

Other relevant field information about these samples (e.g., sample penetration depth, confirmed coordinates, water depth, mudline elevation, and visual observations) will be recorded in the field notebooks and included in the project database. The DQMP (AECOM and Geosyntec 2018a)- provides detailed description of database management and data compilation activities.

4.2.1.2 Subsurface Sediment Sample Nomenclature

The sample nomenclature for subsurface sediment core samples will consist of up to five components: a three-letter project identification code, followed by a sample matrix code, a sample station code, a sample depth interval, and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-SC-S010-2to4 = Pre-design investigation, sediment core, sediment management area station #10, depth interval 2 to 4 feet
- ~~PDI-SC-S010-2to4-D = Pre-design investigation, sediment core, sediment management area station #10, depth interval 2 to 4 feet, field duplicate sample~~

Other relevant field information about these core samples (e.g., sample depth, percent core recovery, ~~in-situ depth versus recovered depth~~, drive depth, total sample volume, and visual observations) will be recorded in field notebooks and included in the project database.

The DQMP (AECOM and Geosyntec 2018a) provides detailed description of database management and data compilation activities.

4.2.1.3 Surface Water Sample Nomenclature

The sample nomenclature for the surface water samples will consist of up to five components: a three-letter project identification code, a sample matrix code, a transect location code, a sampling date, and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- ~~PDI-WS-T07-1807 = Pre-design investigation, water (surface water), transect seven, July 2018.~~
- PDI-WS-T07-1807-D = Pre-design investigation, surface water, transect seven, July 2018, field duplicate sample.
- For ethylbenzene, the transect number will be followed by “E,” “N,” or “W” to indicate location along the transect where E = east, N = navigation channel, and W = west.
- Samples collected for MS or MSD purposes will have the same sample identification as the original sample and will be indicated on the same line on the Chain-of-Custody Record –as the original sample with a comma and then -MS, -MSD next to it. Alternatively -MS, -MSD may be entered in the comment section or line on the Chain-of-Custody Record –where the original sample ID is listed. –Either way, the sample will be considered a single sample and will not be considered three discrete samples.
- ~~PDI-WS-T07-1807-MSD = Pre-design investigation, surface water, transect seven, July 2018, MSD sample~~

The sample identifications will not be different for the specific fractions of surface water (i.e., whole water, filtered water, particulate phase, or XAD-2 adsorbed dissolved phase). Rather, the matrix field within the database will be used to identify the specific fraction. For example, the nomenclature would use “XAD” to represent the dissolved phase of the organic constituents collected using the PR2900 or “F” for field-filtered samples collected using the PP. See the DQMP (AECOM and Geosyntec 2018a) for details.

4.2.1.4 Sediment Trap Sample Nomenclature

The sample nomenclature for the sediment trap samples will consist of up to five components: a three-letter project identification code, a sample matrix code, a sample station code, a sampling date, and a QC code (if appropriate). Examples of the nomenclature scheme are as follows:

- PDI-ST-T07A-1803 = Pre-design investigation, sediment trap, transect seven station A, March 2018
- PDI-ST-T07B-1803-D = Pre-design investigation, sediment trap, transect seven station B, March 2018, field duplicate sample

4.2.1.5 Fish Tissue Sample Nomenclature

The sample nomenclature for the fish tissue samples will consist of three components: a three-letter project identification code, a sample matrix code, and sample number. An example of the nomenclature scheme is as follows:

- PDI-TF-SMB005- = Pre-design investigation, fish tissue, smallmouth bass sample #5

4.2.1.6 Porewater Sample Nomenclature

The sample nomenclature for the porewater samples will consist of three components: a three-letter project identification code, a sample matrix code, and sample station number. Examples of the nomenclature scheme are as follows:

- PDI-WP-B001 = Pre-design investigation, water (porewater) sample co-located with baseline surface sediment station # 1
- PDI-WP-S042 = Pre-design investigation, porewater sample, co-located with SMA surface sediment station # 42

The porewater stations are co-located with existing surface sediment grab stations, and the sediment station location numbers will be used. If the porewater sampling station is placed in a new area (and sediment is not already being collected for another purpose), then a unique station identification will be applied starting sequentially after the SMA samples (e.g., PDI-PW-S190).

4.2.1.7 Fish Tracking Nomenclature

The nomenclature for the fish tracking will consist of three components: a three-letter project identification code, a sample code, and a receiver station number (for acoustic receivers) or an acoustic tag number (for tagged fish). Examples of the nomenclature scheme are as follows:

- PDI-AR-A032 = Pre-design investigation, acoustic receiver, from receiver station 32
- PDI-AT-SMBT40 = Pre-design investigation, acoustic tagged fish, SMB tagged with tag #40

Tagged fish that die may be saved for fish tissue sampling and will be identified using the following nomenclature: a three-letter project identification code, a tagged fish sample matrix code, and the acoustic tag number. An example of the nomenclature scheme is as follows:

- PDI-TF-SMBT32 = Pre-design investigation, fish tissue, SMB tagged with tag #32

4.2.1.8 Blanks Nomenclature

The sample nomenclature for the blank samples will consist of five components: a three-letter project identification code, a QC code for the type of blank, an equipment code (if applicable), a sampling date, and a sampling time (if two or more pieces of equipment are sampled the same day or if two or more trip blanks are submitted on the same day). Examples of the nomenclature scheme are as follows:

- PDI-RB-SC-180612-1430 = Pre-design investigation, rinsate blank of a sediment core tube, collected June 12, 2018 at 2:30 p.m.
- PDI-TB-180515-0830 = Pre-design investigation, trip blank, collected May 15, 2018 at 8:30 a.m.

Below is the list of the equipment codes for equipment that will require rinsate blanks:

- VV = Van Veen sampler
- SC = sediment core tube
- SS = spoons and bowls
- PP = peristaltic pump (and carboys)
- XD = XAD sampler
- XF = XAD filter
- ST = sediment trap
- PW = porewater sampler

No rinsate blanks will be needed for fish sampling tools, because all fish processing will be conducted at the analytical laboratories.

4.2.2 Collection Methods

The sample collection methods, location control, field equipment, and decontamination procedures to be used are described in detail in the FSPs for each media type and in the SOPs for each collection method.

4.2.3 Field Generated Waste and Waste Disposal

Excess water or sediment remaining after sample processing will be returned to the vicinity of the collection Site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection Site before proceeding to the next station.

[Further details on the management of investigation-derived waste \(IDW\) are provided as SOPs in the surface sediment, surface water/sediment trap, subsurface sediment core, and porewater FSPs.](#)

Per the EPA-approved Round 1 FSP (Integral Consulting [Integral] 2004), all disposable materials used in sample processing, such as paper towels and disposable coveralls and gloves, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the Site by sampling personnel and placed in a normal refuse container for disposal at a solid waste landfill. Phosphate-free, detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed into the sanitary sewer system.

4.3 Sample Handling

4.3.1 Hold Times

The first step in proper sample handling and custody is observance of analytical holding times, which can vary from 7 days to 1 year depending upon the media and analytical method(s) selected for the samples. Knowledge of required holding times will have a direct impact on the scheduling of sample collection, packing, and shipping activities. The sample containers, volumes, preservation, and holding times applicable to each analytical method are shown in Table 5 of this QAPP.

4.3.2 Sample Custody

Sample collection and sample custody procedures are designed so that field custody of samples is maintained and documented. These procedures provide identification and documentation of the sampling event and the sample chain-of-custody from shipment of sample bottle ware and pre-cleaned sampling supplies, through sample collection, to receipt of the samples by the laboratory. When used in conjunction with the laboratory's custody procedures and documentation, these data establish full legal custody and allow complete tracking of a sample from preparation and receipt of sample bottle ware to sample collection, preservation, and shipping through laboratory receipt, sample analysis, and data validation. The chain-of-custody is defined as the sequence of persons who have the item in custody. Field custody procedures, sample packing, and shipping are described below. The persons responsible for sample custody, and a brief description of their duties, are as follows:

- **Laboratory Sample Custodian or Commercial Supplier:** Verifies that the bottle ware is certified clean; arranges for bottle ware shipment to field sampling personnel.
- **Field Staff:** Receive sample bottle ware from laboratory, inspect bottle ware for physical integrity; retain shipping invoice or packing list from shipping courier as documentation of transfer of bottle ware; collect and preserve samples; retain bottle ware and samples

under custody until sample shipment; relinquish samples to shipping courier or to laboratory representative.

- **Laboratory Project Manager (LPM):** Verifies reported laboratory analyses to the sample Chain-of-Custody Record; assures that chain-of-custody documentation is incorporated into the project file.

A sample or other physical evidence is in custody if it is or was:

- In the field investigator's, transferee's, or laboratory technician's actual possession.
- In the field investigator's, transferee's, or laboratory technician's view after being in his/her physical possession.
- In the field investigator's, transferee's, or laboratory technician's physical possession and then he/she secured it to prevent tampering.
- Placed in a designated secure area.

4.3.3 Chain-of-Custody Record

The field Chain-of-Custody Record is used to record the custody of samples or other physical evidence collected and maintained. This form will not be used to document the collection of split or duplicate samples. The Chain-of-Custody Record also serves as a sample logging mechanism for the analytical laboratories' sample custodian.

The following information must be supplied in the indicated spaces in detail to complete the field Chain-of-Custody Record:

- Project-specific information, including the project number and project name.
- The signature of the sampler and/or the sampling team leader in the designated signature block.
- The sampling location identification number, date, and time of sample collection, grab or composite sample designation, and sample preservation type must be included on each line (each line should contain only those samples collected at a specific location).
- The total number of sample containers must be listed in the indicated space for each sample, and the total number of individual containers must also be listed for each type of analysis.
- The field investigator and subsequent transferee(s) must document the transfer of the samples listed on the Chain-of-Custody Record in the spaces provided at the bottom of the form. Both the person relinquishing the samples and the person receiving them must sign the form and provide the date and time that this occurred in the proper space on the

form. Usually, the last person receiving the samples or evidence should be a laboratory sample custodian.

- The remarks column at the bottom of the form is used to record air bill numbers or registered or certified mail serial numbers.

The Chain-of-Custody Record is a serialized document; once it is completed, it becomes an accountable document and must be maintained in the project file. The suitability of any other form for chain-of-custody should be evaluated based on its inclusion of the above information in a legible format. Examples of Chain-of-Custody Records for each laboratory described in this document are provided as Appendix B.

4.3.4 Sample Packing and Shipping

Samples are packed for shipping in waterproof ice chests and coolers. Depending upon container type, the sample containers may be individually sealed in Ziploc® or other similar plastic bags prior to packing them in the cooler with bubble wrap or Styrofoam packing. Wet ice will be double-bagged in plastic bags (to inhibit cross contamination of samples by melt water) and placed with the samples in the cooler to maintain the samples at a temperature of 0 to less than 6 degrees Celsius (°C) during shipping. Tissue samples will be frozen upon collection and shipped to the designated laboratories on dry ice. Specific shipping instructions for fish samples shipped on dry ice will be followed per information provided by the specific carrier and described in the Fish Tissue FSP. Samples being shipped to SGS AXYS in Sidney, British Columbia, Canada will also include a commercial invoice form provided by SGS AXYS with the supply order. The commercial invoice forms will include language provided by SGS AXYS that Canada Customs will need to clear the shipment, and SGS AXYS will be listed as the consignee and the importer of record on the commercial invoice forms. To ensure holding times and proper storage requirements are met, Friday shipments to Canada will be avoided if possible.

The Chain-of-Custody Record that identifies the samples is signed as "relinquished" by the principal sampler or responsible party. This Chain-of-Custody Record is sealed in a waterproof plastic bag and is placed inside the cooler, typically by taping the bag to the inside lid of the cooler.

Following packing, the cooler lid is sealed with packing tape. A Two custody seals ~~is-are~~ signed, dated, and affixed from the cooler lid to the cooler body on two adjacent sides, and ~~is-are~~ also covered with clear tape. This ensures that tampering with the cooler contents will be immediately evident.

The sample coolers will be shipped by courier to the laboratory in accordance with laboratory schedule requirements. A copy of the shipping invoice is retained by the field manager and becomes part of the sample custody documentation.

4.4 Laboratory Procedures

The analytical laboratories named in this QAPP have established programs of sample custody that are designed to ensure that each sample is accounted for at all times. The objectives of these sample custody programs include the following:

- Unique identification of the samples, as appropriate for the data required
- Analysis of the correct samples and traceability to the appropriate record
- Preservation of sample characteristics
- Protection of samples from loss or damage
- Documentation of any sample alteration (e.g., filtration, preservation)
- Establishing a record of sample integrity for legal purposes

The SOPs for sample custody protocol are maintained by the laboratories and adhered to by laboratory personnel. The sample custody SOPs are in the laboratories' SOP libraries and/or QA manuals.

Tagged fish that are submitted for fish tissue chemistry will be clearly identified when submitted to the laboratory using a note on the sample bag and chain-of-custody record indicating "tagged fish." Before fish processing, the laboratory will remove the internal acoustic tag and external identification tag, record the tag IDs, and archive the tags in a sealed bag labeled with the fish sample ID.

4.4.1 Intra-Laboratory and Sub Laboratory Sample Transfer

The laboratory project manager will ensure that a sample-tracking record is maintained that follows each sample through all stages of laboratory processing. The sample-tracking record must contain, at a minimum, the names of individuals responsible for performing the analysis; the dates of sample extraction, preparation, and analysis; and the type of analysis being performed.

Any sample, homogenate, or sample extract that will need further analysis that is not performed by the initial contracted laboratory and that requires inter- or intra-laboratory transfer will be subject to all specifications described in the previous section. Sample matrices and analyses per specific laboratory, as shown in Tables 2a through 2e, will not be subcontracted to outside laboratories or transferred to other laboratories within the specific laboratory organization without consultation with the PDI Project Manager, the PDI Project Coordinator, and the EPA.

4.4.2 Archived Samples

All excess sediment and tissue samples submitted to the analytical laboratory will be archived at less than -10 °C and all excess water samples submitted to the analytical laboratory will be stored at 0 to 6 °C. The extracts for water samples will be archived at less than -10 °C. The laboratories will maintain chain-of-custody documentation and proper storage conditions for the entire time that the samples are in their possession. All laboratories for this project will store the excess samples for up to 12 months following completion of data validation. The laboratories will not dispose of the samples for this project until they are authorized to do so by the Project QA/QC Manager and/or EPA.

4.5 Analytical Methods

Liquid and solid samples will be extracted, prepared, and analyzed for organic and inorganic parameters by the methods specified in EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) and additional EPA methods under the Clean Water Act ([EPA-1600-series-methods40 CFR part-136](#)) as noted in Tables 2a through 2e. Sample analysis methods will follow the laboratory SOPs and the referenced methods. The QC limits for these analyses are shown in Tables 2a through 2e. A list of referenced Laboratory SOPs for these analyses are provided as Appendix A. Analytical methods are generally consistent with EPA-approved QAPPs from the RI (Striplin Environmental Associates [Striplin] 2002, Integral 2004), EPA guidance on collecting and manipulating sediment data (EPA 2014), and Puget Sound Estuary Program (PSEP) protocols (PSEP 1996).

4.6 Quality Control

A QC system is a set of internal procedures used by the field team and laboratory for assuring that the data output of a measurement system meets prescribed criteria for data quality. A well-designed internal QC program must be capable of controlling and measuring the quality of the data in terms of precision and accuracy. Precision reflects the influence of the inherent variability in any measurement system, and accuracy reflects the degree to which the measured value represents the actual or "true" value for a given parameter, and includes elements of both bias and precision.

This section addresses QC procedures associated with field sampling and analytical efforts. Included are general QC considerations as well as specific QC checks that provide ongoing control and assessment of data quality in terms of precision and accuracy. Table 6 summarizes the requirements for the collection of QC samples in the field.

4.6.1 Field Quality Control

Field QC samples are collected in the field and used to evaluate the validity of the field sampling effort. Field QC samples are collected for laboratory analysis to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and

purpose of field QC samples that will be collected for this project. Table 6 provides a summary of the types and frequency of collection of field QC samples:

- **Field Duplicates:** Field duplicates are additional samples collected at a sampling location from the bowl or container of field-composite material and then split into two unique samples to enable statistical analysis of the resulting data. Two sets of samples from a single source are prepared, labeled with unique sample numbers, and submitted to the laboratory. One field duplicate will be prepared for every 20 environmental samples collected for each matrix type except fish tissue and high-volume surface water samples. Field replicates (unique samples processed from co-located stations in the field) are not planned for this PDI study because most of the field samples are composites.
- **Equipment Blanks:** Field equipment blanks will be used to assess the introduction of chemical contaminants during sampling and field processing activities and to help determine if decontamination procedures are effective at removing contaminated material from non-dedicated sampling equipment. Field equipment blanks will consist of rinsate blanks collected by pouring anywhere from 3 to 6 liters of de-ionized water over or through decontaminated sampling equipment and collected in the appropriate sample containers (1-liter amber glass). Equipment surfaces exposed during actual sampling will be rinsed. These samples will be analyzed along with the field samples. No rinsate blanks will be collected from disposable field equipment. Field equipment rinsate blanks will be generated for all chemical parameter groups, with one equipment blank being collected for every 20 analytical samples and submitted for analysis to the laboratory for the same constituents targeted in that day's sampling. The task-specific FSPs provide more detail on the procedures for generating equipment blanks. ~~For~~ For surface water sampling, in particular, three equipment blanks will be collected per sampling event: deionized (DI) water run through XAD tubing, column cartridge and equipment to collect a water sample, DI water run through the XAD cartridge to collect a "particulate" phase blank, and DI water run through the PP equipment. A filter blank of the 0.45-micron filter run in-line with the PP tubing for dissolved metals is not necessary because those filters come certified from the laboratories. Rinsate blanks for the high-volume sampling equipment (PR2900) are further described in the surface water and sediment trap sampling FSP and XAD sampling SOP.
- **Trip Blanks:** Field trip blanks will be used to determine if VOCs are introduced to samples during holding, shipping, or storage prior to analysis. Trip blank samples are prepared in the laboratory by filling a clean sampling container with reagent-grade DI water. The sample is then taken to the Site and handled with the other project samples and then submitted for analysis. One trip blank sample will be included in each container used to transport VOC samples to and from the laboratory. Trip blank samples will be analyzed for VOCs by EPA Method 8260C only. Laboratory results of trip blank samples will be analyzed to assess potential contamination associated with sample handling and shipping.

- **Field Blanks:** Field blanks will be used for low concentration surface water sampling to determine if background or atmospheric conditions are introducing COCs into the environmental surface water samples. Field blanks are prepared by pouring reagent-grade analyte-free water into the same sample bottles at the location where the surface water samples are being collected and analyzed for the same analytical suite as the surface water sample(s). Field blanks will be collected at the frequency of one per event of each round of surface water sampling.

The results of the analyses of these QC sample types will be used as independent, external checks on laboratory and field contamination as well as the precision of analyses.

4.6.2 Analytical Laboratory Quality Control

The analytical laboratories QC procedures will be consistent with the requirements of the analytical methods and the laboratories SOPs (Appendix A). The LPMs will oversee the activities of all analytical chemistry support staff employed on this project. Oversight will be achieved through on-site audits and reviews of analytical facilities prior to and during analysis of project samples (see Section 5 for further details). Types and frequencies of analytical QC samples are shown in Table 6.

Analytical laboratory QC samples are used to evaluate PARCCS parameters for the analytical results (Table 7). Analytical methods specify routine procedures that are required to evaluate whether data are within proper QC limits. Additional internal QC includes collection and analysis of field and laboratory QC samples, as described in the sections that follow.

4.6.2.1 Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. A method (or preparation) blank is prepared at the frequency specified by the referenced method, typically one per preparation batch (a preparation batch is defined as a group of samples prepared together within a 24-hour time frame, not to exceed 20 samples). The purpose of the method blank is to ensure that contaminants are not introduced by the bottle ware, reagents, standards, personnel, or the sample preparation environment.

4.6.2.2 Matrix Spikes and Matrix Spike Duplicates

MS/MSD duplicate pairs provide information to assess precision and accuracy. The MS is a second, extra aliquot of an environmental sample to which known concentrations of target analytes have been added. The MS is carried through the entire analytical procedure, and the recovery of the analytes is calculated. Results are expressed as %R. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis. The MSD is a third, extra aliquot of an environmental sample that is also spiked with the same known concentrations of analytes used for the MS. The two spiked aliquots are processed separately, and the results are compared

to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as RPD and %R.

One MS/MSD set will be analyzed for every 20 investigative samples as applicable to the method. The MS/MSD will be site-specific and field personnel will therefore be responsible for collecting additional sample volumes (three times the normal volume) to account for the MS/MSD samples.

4.6.2.3 Laboratory Control Sample

LCS are used to monitor the laboratory's day-to-day performance of routine analytical methods independent of matrix effects and are prepared at a frequency of one per preparation batch. LCS are fortified with spike standard solutions containing target parameters of interest. The recovery of these standards is quantitatively measured during analysis, and historical records are maintained on the percent recovery for each sample.

4.6.2.4 Surrogate Spikes

Surrogate spike analyses provide information on a laboratory's ability to recover the analytes of interest. The surrogate spike is carried through the entire analytical procedure, and the recoveries of the surrogate spikes are calculated. Results are expressed as percent recovery for each sample. Surrogates are added to samples based on the specifications of the individual analytical method.

4.6.2.5 Certified Reference Material

Each laboratory will analyze certified reference materials (CRM) per analysis per matrix, if available, at a frequency of at least once at the beginning of each project task that has an analytical component. Otherwise, analysis of CRMs will be per the requirements of the analytical method and laboratory QA program as applicable. The CRM results will be assessed against the acceptance criteria provided by the CRM vendor.

4.7 Instrument/Equipment Quality Control

[4.7.1 Laboratory Instrument/Equipment Quality Control](#)

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted in accordance with the QC requirements identified in each laboratory's SOPs. In addition, each of the specified analytical methods provides protocols for proper instrument calibration, setup, and critical operating parameters.

Preventive maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. At a minimum, the preventative maintenance schedules contained in the EPA methods and laboratory SOPs and in the equipment manufacturer's instructions will be followed. This maintenance includes routine care and cleaning of instruments, and inspection and

monitoring of the carrier gases, reagents, solvents, reference materials, and glassware used in analysis. All maintenance of instruments and procedures will be documented in maintenance log/record books. Each of the laboratories has SOPs for preventive maintenance that are contained in their individual QA manuals.

4.7.2 Field Equipment Quality Control

Field equipment requiring calibration, maintenance, inspection, and decontamination will be conducted in accordance with the project-specific FSPs, SOPs, and manufacturers' instructions.

4.8 Inspection/Acceptance of Supplies and Consumables

Sample container requirements are shown in Table 5. Other supplies include, but are not limited to, DI water, chemicals for decontamination, sample collection equipment, and personal protective equipment. All will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be kept in project files.

4.9 Non-Direct Measurements

Existing chemical and biological data from previous investigations in the lower Willamette River were compiled from historical databases and technical reports. All data were reviewed for QA prior to entry in the project database. The historical data, results of the QA review, and acceptance criteria for use are described in the PDI Work Plan (Geosyntec 2017). The historical data meeting QA requirements were one of several elements considered in developing the PDI Work Plan.

4.10 Data Management

Documentation and data management are critical steps in maintaining quality during the PDI activities. Documentation and data management begin with the development of appropriate field forms prior to field mobilization, continue with appropriate recordkeeping in the field and adequate analytical documentation and reporting, and conclude with thorough records management and database population after the work has been completed. Detailed information regarding database management is provided in the project DQMP (AECOM and Geosyntec 2018a).

4.10.1 Field Logbooks and Forms

Field visits and sample collection programs are documented using a combination of field logbooks and specific field log forms.

A logbook will be in use for all visits to the Site, ranging from brief Site walks to major, multi-week characterization programs. If the work is short in duration (e.g., less than 1 day) and

irregular or *ad hoc* in nature (i.e., a task that is not captured by a standard field form), then all the work will be documented in the logbook. Conversely, if the Site visit is longer in duration and more repetitive (e.g., a major sediment or surface water sampling event), corresponding field forms will be used for documentation of each sample, whereas the logbook will be used to document a summary of the day's activities and non-repetitive tasks, including the following:

- Time of arrival and departure from the Site, including lunch breaks
- Names of field team members
- Time of arrival and departure of subcontractors
- The nature of the daily health and safety tailgate meeting
- Instrument calibration
- Supply deliveries
- Weather
- Interaction with agency or client personnel
- Incident occurrence and management
- Any other irregular or *ad hoc* activities

As such, the logbook(s) will provide a comprehensive overview of all Site activities throughout the PDI. The level of detail of the documentation within each logbook entry will depend upon the duration of an individual visit and the applicability of field forms to the tasks performed.

4.10.2 Electronic Data Management

Data management for the PDI is governed by EPA Region 10 specifications. These specifications indicate a standardized database schema for electronic data reporting to the consultant, entry into the Site database, and delivery to EPA Region 10 with data reports. Data management requirements are also discussed in the DQMP (AECOM and Geosyntec 2018a).

5. DATA QUALITY ASSESSMENT

5.1 Assessments and Response Actions

The Project QA/QC Manager or their designee may conduct both performance and systems audits of field and laboratory activities, as necessary. This section discusses the types of audits, including system audits of the field and laboratory prior to project startup and ongoing field and laboratory performance audits over the course of project activities.

5.1.1 Systems Audit

A systems audit consists of the evaluation of key components of the measurement systems to determine their proper selection and use. This audit includes a careful evaluation of both field and laboratory QC procedures. When required by EPA or an alternative regulatory authority, systems audits are performed prior to or shortly after systems are operational.

5.1.1.1 Field Systems Audits

The field systems audit is an on-site audit that focuses on data collection systems, using this QAPP as a reference. Specific activities vary with the scope of the audit, but can include a review of the following:

- Sample collection activities
- Equipment calibration techniques and records
- Decontamination and equipment cleaning
- Background and training of personnel
- Sample containers and preservation techniques
- Chain-of-custody [—verification of sample IDs against collection records and sample container IDs](#)

5.1.1.2 Laboratory Systems Audit

The laboratory systems audit is a review of laboratory operations to verify that the laboratory has the necessary facilities, equipment, staff, and procedures in place to generate acceptable data.

Specific activities vary with the scope of the audit, but can include a review of the following:

- Equipment suitability and maintenance/repair
- Background and training of personnel
- Laboratory control charts and support systems

- QA samples, including performance evaluation samples
- Chain-of-custody procedures
- Data logs, data transfer, data reduction, and validation

5.1.2 Performance Audits

After systems are operational and generating data, EPA may request that a performance audit be conducted to determine the accuracy of the total measurement system(s) or component parts thereof.

5.1.2.1 Laboratory Performance Audits

The project laboratories participate in a variety of federal and state programs that subject laboratories to stringent performance audits on a regular basis. QA policies and procedures currently in place at the laboratories, and actions that will be included in sampling activities to ensure QA conformance, include the following:

- Both intra-laboratory and inter-laboratory check samples
- Periodic (at least annual) audits conducted by the corporate QA office
- Laboratory control samples prepared and/or analyzed as applicable to the method(s) at a frequency equal to at least 5% of the total number of samples analyzed

Laboratory performance will be monitored by the Project QA/QC Manager. If necessary, or at the request of the EPA RPM, the Project QA/QC Manager will conduct an on-site audit of field operations or any of these laboratories at a frequency of no more than once per year per laboratory or once per major sampling event.

5.1.2.2 Field Performance Audits

Performance audits of field screening and sampling activities will be conducted by the PDI Project Manager and/or the Project QA/QC Manager to assess the performance and adequacy of sample collection procedures and will include the following:

- Observing sample collection activities
- Reviewing field notebooks
- Reviewing the chain-of-custody documents prior to shipping
- Inspecting sample containers being shipped
- Reviewing laboratory sample receipt forms

~~An inspection for suitability of the samples for proper laboratory analysis serves as the performance audit of the sample collection procedures. Volatiles possessing free air (i.e., a bubble in an aqueous sample vial), insufficient sample volume for analysis, or improper preservation of samples will be noted by the analytical laboratory. A preponderance of such reports of unsuitable samples will indicate that the sampling procedures are poor or unacceptable. Analytical results will be reviewed by the PDI Project Manager and the Project QA/QC Manager to assess the performance and adequacy of sample collection procedures.~~

5.1.3 Corrective Action for Measurement Systems

When a problem situation arises regarding any significant impediment to the progress of the PDI, corrective action will be implemented to identify the problem and its source. Appropriate documentation of this action will be recorded in the project file.

Personnel responsible for the initiation and approval of a corrective action will be the laboratory QA manager (for a corrective action at the laboratory) and the Project QA/QC Manager (for corrective actions identified during field activities and/or during the data validation effort). The PDI Project Manager will be responsible for the approval of corrective action measures.

5.1.3.1 Laboratory Corrective Action and Response

When the analysis of any sample indicates the analytical system may be out of control, the laboratory will stop analysis until the source of the problem is identified and corrected. The laboratory manager is also notified, and the corrective action is approved and implemented. This corrective action may include, but is not limited to, the following:

- Removal of an instrument from service
- Isolation and correction of the source of the problem
- Reanalysis of the failing QC sample

To minimize the chances for an out-of-control situation to occur, the laboratory manager will be provided feedback on performance evaluations in a timely manner by analysts, group supervisors, and the laboratory QA manager.

5.1.3.2 Field Measurement Corrective Action and Response

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the field manager. This supervisor will be responsible for assessing the suspected problems in consultation with the Project QA/QC Manager and for making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation indicates a reportable nonconformance requiring corrective action, a nonconformance report will be initiated by the field manager.

The field manager will be responsible for ensuring that corrective action for nonconformances is initiated by:

- Evaluating reported nonconformances
- Controlling additional work on nonconforming items
- Determining the disposition or action to be taken
- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring nonconformance reports are included in the final Site documentation in project files

If appropriate, the field manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective actions for field measurements may include the following:

- Repeating measurements to check the error
- Checking for proper adjustments for ambient conditions such as temperature
- Checking the batteries
- Recalibrating
- Checking the calibration
- Replacing the instrument measuring devices
- Stopping work (if necessary)

The field manager or his/her designee is responsible for Site activities. In this role, the field manager at times is required to adjust the Site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the field manager of the anticipated change and implements the necessary changes after obtaining the approval of the field manager.

Corrective actions will be implemented and documented in the field logbook. No staff member will initiate a corrective action without prior communication of findings through the field manager.

5.2 Quality Assurance Reporting Procedures

This section presents the QA reporting procedures that will be implemented for this project.

5.2.1 Reporting Responsibility and Recordkeeping

Comprehensive records will be maintained by the Pre-RD AOC Group to provide evidence of QA activities.

These records will include the following documentation:

- Results of performance and systems audits
- Data validation summary reports
- Significant QA problems and proposed corrective actions
- Changes to this QAPP

The proper maintenance of QA records is essential to provide support in any evidentiary proceedings. The original QA records will be kept in the Project QA/QC Manager's records.

Access to working files will be restricted to project personnel. Upon termination of an individual task or work assignment, working files will be processed for storage as QA.

5.2.2 Monthly Progress Reports

Descriptions of completed tasks will be forwarded to the EPA RPM as part of the monthly progress report for the Site.

5.2.3 Audit Reports

Should audits be requested by the EPA, the corresponding audit reports will be distributed to the following project personnel, as appropriate:

- EPA, PDI Project Manager, and PDI Project Coordinator
- Project Field Coordinator
- Laboratory QA/QC Manager

6. DATA VALIDATION AND USABILITY

This section describes the stages of data quality assessment after data have been received. It addresses data reduction, review, verification, and validation. It also discusses the procedures for evaluating the usability of data with respect to the DQOs set forth in Section 3.

6.1 Data Reduction

Raw analytical data generated in the laboratory are collected on printouts from the instruments and associated data system or are manually recorded in bound notebooks. Analysts review data as they are generated to determine that the instruments are performing within specifications. This review includes calibration checks, surrogate recoveries, blank checks, retention time reproducibility, and other QC checks as specified in the SOPs and applicable to the method. If any problems are noted during the analytical run, corrective action is taken and documented.

6.2 Data Review

Data review is an initial and relatively non-technical step of data assessment that primarily addresses issues of completeness and data handling integrity. In data review, the reviewer will ensure that the necessary reporting components have been included in laboratory reports, such as necessary fields (e.g., collection/analysis dates, units) as well as the presence of (but not implications of) QA/QC data components (e.g., LCS records, surrogate results).

6.3 Data Verification and Validation

Data verification is a more technical process than data review in that the core technical aspects of data quality (e.g., precision, accuracy) are evaluated through a review of the results of QA/QC measures, such as LCS and surrogates.

Following interpretation and data reduction by an analyst, data are transferred to the laboratory sample management system either by direct data upload from the analytical data system or manually. The data are reviewed by the group leader or another analyst and marked on the sample management system as being verified. The person performing the verification reviews the data, including QC information, prior to verifying the data. If data package deliverables have been requested, the laboratory will complete the appropriate forms summarizing the QC information and transfer copies of the raw data (e.g., instrument printouts, spectra, chromatograms) to the Data Packages Group. This group will combine the information from the various analytical groups and the analytical reports from the laboratory sample management system into one package. This package is reviewed by the LPM for conformance with SOPs and to ensure that project QC goals have been met. Any analytical problems are discussed in the case narrative, which is also included with the data package deliverables.

Following data verification by the laboratory, data validation will be conducted.

A [full validation as described for EPA Stage 4 validation](#) (review of raw data and calculation checks) will be conducted on 10% [of the data per analytical test and per matrix where instrument outputs are generated as part of the analysis \(e.g., HRMS, GC, ICPMS, etc.\)](#). ~~For those analyses where instrument outputs are not generally part of the procedure but where data are recorded for purposes of calculation or data reduction to a final result (e.g., total solids, grain size), 10% of the data per analytical test and per matrix will be validated as described under EPA Stage 3.~~ [of the data per analytical test and per matrix](#) by the project data validation team. [EPA Stage 2A data validation](#) (review of summary forms presented for applicable method QA/QC parameters) will be conducted on 90% of the laboratory data by the project data validation team. The project data validation team is considered independent since the members of the team are not affiliated with the analytical laboratories, the sampling effort, or to the data user (EPA 2002b). If during the [EPA Stage 2A data validation](#), systematic data quality issues are identified with the analytical data, the laboratory will be contacted, and the data will be validated at an [EPA Stage 4 level](#) until the data quality issues are resolved.

Validation may be done on hard-copy data with the assistance of an automated validation screening program performed electronically, if applicable and/or available. Data will be evaluated based on the method requirements, work plan requirements, and current laboratory criteria at the time samples were submitted to the laboratory. If there are QC results outside of criteria range or method requirements, the affected data may be qualified based on the potential effect of the out of compliance item on the data quality. Qualifiers will be assigned using professional and technical judgement of qualified validation personnel and guidance for assigning data qualifiers outlined in the EPA documents National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2017c), January 2017; National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 2017d), January 2017; and National Functional Guidelines for High Resolution Superfund Methods Data Review (EPA 2016c), ~~as well as any Regional 10 EPA validation guidance that may also be pertinent~~ [utilized if a validation element is not covered in National Functional Guidelines and is available in the regional guidance](#). ~~After data validation and database management, data interpretation will follow the methods outlined in Table 8.~~

6.3.1 Data Validation and Usability Determination

While data verification is a technical process in which the data's adherence to core PARCCS elements is evaluated, it still does not answer the final question of the usability of the data and the implications of any departures from data expectations. The data validation process is designed to answer these questions through: 1) the assignment of data qualifiers based on the data verification results; and 2) a case-by-case review of data quality issues with respect to QAPP objectives to render a final assessment of data usability.

The final step of data evaluation entails a comparison of data quality performance with the QAPP-specific DQOs. Section 3.2 of this QAPP discusses the PDI objectives and Table 3 outlines the required data inputs and associated required quality metrics references. Validation of

the analytical data is the process of determining that the data support the task-specific DQOs. Validation is performed by the independent validator as well as the project team, as data usability is also determined once put into context of the entire data set. ~~Where summing of analytical results is required (e.g., total PAHs), the most recent summing rules process used for ROD decision making will be followed (see (EPA December 2017) referenced in Appendix A of the RI/FS report should will be followed (EPA 2016a); this process is consistent with, and has been clarified in, a recent summation rules memo issued by EPA in December 2017 (EPA 2017e). This memo states a preference for using the risk assessment-based summing rules, especially in the treatment of non-detects for individual members of chemicals groups.~~

6.4 Data Evaluation Roles and Responsibilities

The components of data evaluation will be performed by the entities noted in the following list:

- Data reduction will be performed by the analytical laboratory.
- Data review will be performed both by the laboratory and by the data validator.
- Data verification will be performed both by the laboratory and by the data validator.
- Data validation and usability determination will be performed by the data validator and the project team.

6.5 Data Reporting

Laboratory reports will contain an [EPA](#) Level 2 Data Package and an [EPA](#) Level 4 Data Package.

6.5.1 [EPA](#) Level 2 Data Package

- Case Narrative: Description of sample types, tests performed, any problems encountered, corrective actions taken, and general comments are given.
- Analytical Data: Data are reported by sample or by test. Pertinent information (such as dates sampled, received, prepared, or extracted) is included on each results page. The PQL and MDL for each analyte are also provided. In addition to a hard-copy report or PDF copy of the report, laboratories will provide an electronic data deliverable (EDD) in a text format corresponding to each analytical report. The EDD generated by the laboratories will comply with the PDI requirements described in the DQMP.
- Laboratory Performance QC Information: The results of the LCS and surrogate recoveries (as applicable) analyzed with the data set are listed, together with the control limits. Also, the analytical results for method blanks generated during analysis of organic and inorganic parameters are reported.

- Laboratory Duplicate Data: Laboratory duplicate results together with RPD control limits are reported.
- Matrix-Specific QC Information: The results of any field sample duplicates, MSs, and MSDs that are requested, along with the specific laboratory acceptance criteria, are reported.
- Methodology: The reference for the applied analytical method (or methods) is cited.
- Email Communications: Email communications between the laboratory and consultant team that provide additional instructions or corrections to the laboratory are included.
- Chain-of-Custody: Chain-of-custody documentation and sample receiving documentation are included.

6.5.2 [EPA](#) Level 4 Data Package

An [EPA](#) Level 4 Data Package includes all the elements listed above for the [EPA](#) Level 2 package, but also includes the following:

- All the pertinent standards information and traceability and standard logbook information for individual standard solutions
- All the pertinent calibration data and continuing calibration data, including tune information
- All the raw data chromatograms and instrument printouts for the sample results and calibration data
- [Internal standard area and retention time summaries](#)
- [Ion abundance ratio summaries for high resolution mass spectroscopy analyses](#)
- All the pertinent sample preparation information
- Preparation batch and analytical batch associations
- [Before and after manual integration chromatograms](#)
- [Run logs for all analyses](#)
- Any correspondence that occurred between the laboratory and the client regarding sample issues

7. REFERENCES

- AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. ~~January~~22 February.
- AECOM and Geosyntec. 2018b. Health and Safety Plan. Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. ~~January~~13 March.
- EPA (United States Environmental Protection Agency). 2001. EPA Requirements of Quality Assurance Project Plans (EPA QA/R-5). March. EPA/240/B-01/003.
- EPA. 2002a. EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5). December. EPA/240/R-02/009.
- EPA. 2002b. EPA Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8). November. EPA/240/4-02/004.
- EPA. 2005. Uniform Federal Policy for Quality Assurance Project Plans Part 1 UFP-QAPP Manual, Intergovernmental Data Quality Task Force, Version 1. March. EPA-505-B-04-900A.
- EPA. 2006. EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4). February. EPA/240/B-06/001.
- EPA. 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update V.
- EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.
- EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.
- EPA. 2016c. National Functional Guidelines for High Resolution Superfund Methods Data Review (OLEM 9200.3-115). EPA-542-B-16-001. April 2016.
- EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.
- EPA. 2017b. Administrative Settlement Agreement and Order on Consent and Statement of Work for Pre-Remedial Design Investigation and Baseline Sampling. Agreement between EPA

Region 10, Seattle, Washington and the Pre-Remedial Design Group. CERCLA Docket No. 10-2018-0236. 19 December.

EPA. 2017c. National Functional Guidelines for Organic Superfund Methods Data Review (SOM02.4). January. EPA-540-R-2017-002.

EPA. 2017d. National Functional Guidelines for Inorganic Superfund Methods Data Review (OLEM 9355.0-135). EPA-540-R-2017-001. January.

~~EPA. 2017e. EPA Data Summation Rules 12-12-17, Portland Harbor Data Summation Rules to accompany QAPP comments provided on the PDI programmatic QAPP. Comments provided to the Pre-RD AOC Group on 2-9-18. 12 December 12, 2017.~~

Geosyntec (~~Geosyntec Consultants, Inc.~~). 2017. Final Work Plan. Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10 (attached to the final Statement of Work). 19 December.

Integral (Integral Consulting). 2004. Round 2 Round 2 Quality Assurance Project Plan Final Report, Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 24 June.

PSEP (Puget Sound Estuary Program). 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Tetra Tech and HRA, Inc., Bellevue, Washington.

Striplin (Striplin Environmental Associates). 2002. Portland Harbor RI/FS Round 1 Quality Assurance Project Plan Final Report, Prepared for the Lower Willamette Group. 22 November.

TABLES

FIGURES

APPENDIX A

Supplemental Laboratory Information: Laboratory Standard Operating Procedures and Quality Information

- Laboratory Document References
- Quality Assurance Manual TestAmerica (TA) Sacramento
- Quality Assurance Manual TA Knoxville
- Quality Assurance Manual TA Seattle
- Quality Assurance/Quality Control Manual SGS AXYS
- Quality Assurance Manual ALS Environmental Kelso
- TA Sacramento Washington State Certification (ELAP)
- TA Seattle Oregon Certification (ELAP)
- TA Sacramento Oregon Certification (ELAP)
- TA Knoxville Oregon Certification (ELAP)

APPENDIX B

Example Chain-of-Custody

AECOM
111 SW Columbia Avenue
Suite 1500
Portland
OR, 97217
USA
aecom.com

Geosyntec
520 Pike Street
Suite 1375
Seattle
WA, 98101
USA
geosyntec.com